**State of New Hampshire**

**Site Evaluation Committee**

**Docket No. 2008-04**

**Granite Reliable Power LLC**

**Direct Pre-filed Testimony of Lisa Linowes**

**On behalf of the Industrial Wind Action Group**

**January 5, 2009**

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**1) Please state your name and address for the record.**

My name is Lisa Linowes, and my address is 286 Parker Hill Road, Lyman, NH 03585.

**2) Please summarize your education and background as it relates to this matter.**

I have served as Executive Director of Industrial Wind Action Group (Windaction.org) since its formation in 2006. Prior to that time I was a founder of a second organization, National Wind Watch, and served as its Vice President and spokesperson. In these respective, full-time capacities, I am responsible for tracking wind energy development worldwide with specific focus on the impacts of industrial-scale wind energy development on the natural environment, communities, and the regional grid systems.

I have has been invited to speak on the topic at numerous venues throughout the United States including:

- National Association of Regulatory Utility Commissioners (NARUC) Annual Meeting (Nov 2007),
- Society of Environmental Journalists annual meeting of the (2006), University of Vermont (2006)
- Boston Museum of Science lecture series (2007).
- Energy Bar Association (EBA)'s Annual Regional Midwest Energy Conference (Mar, 2009)

Fellow participants at these venues included industry and policy experts:

- Michael O'Sullivan, senior VP at FPL Energy LLC,
- Tom Gray of AWEA,
- Steve Lindenberg of the Department of Energy, and
- David Rappaport, developer, East Haven project previously before Vermont Public Service Board.

I have served as a member of the New Hampshire Wind Energy Facility Siting Guidelines Working Group to determine guidelines for the siting of land-based wind turbines. The committee was focused on minimizing and avoiding impacts of large-scale wind development on wildlife and sensitive habitat areas. I was an active participant in the ISO-NE's Scenario Planning Process to determine regional energy requirements to meet growing demand in the region. I have over ten years experience in land use and zoning issues and have served on local land use boards and conservation commissions. In addition, I've served as a director of the NH Association of Conservation Commissions. My formal education includes a Bachelor in Science in

Software Science from the Rochester Institute of Technology and an MBA from Southern New Hampshire University.

**3) Why did you petition to become an intervenor in this matter before the NH SEC?**

Windaction.org subscribers number close to 1700 with the majority residing in eastern U.S. states including New Hampshire and its three bordering states. Our subscribers have a strong interest in ensuring wind energy proposals are considered in a deliberate and comprehensive manner with a keen focus on the costs of such development. Up to a third of Windaction.org subscribers reside within the ISO-NE control area and will be directly and substantially affected by the outcome of this proceeding. Further, this project is proposed for high-elevation sensitive habitat and the outcome of this proceeding will have far-reaching impact. Windaction.org strongly avers that the record built through this proceeding will serve to substantially balance and influence any future proceedings involving wind energy development before the Site Evaluation Committee. Thus Windaction.org subscribers across will be directly and substantially affected by this proceeding at the local and regional levels.

**4) Do you oppose wind energy?**

No. There is a place for generation powered by wind. However, such development must be properly sited to ensure sufficient benefit that can justify any qualitative and quantitative environmental, health and societal impacts. We are hopeful that these proceedings before the NH SEC will reach some conclusive understanding of the project's benefits and costs.

**5) Are you satisfied that pre-construction avian surveys conducted by the applicant correctly identified risk to migrating <u>diurnal</u> (daytime) birds (raptors)? Please explain.**

No. According to the Hawk Migration Association of North America (HMANA), the raptor migration period begins in mid-to-late August and continues into November. Peak migration in New Hampshire, particularly for broad-wings, typically occurs during the first three weeks of September. Migration is dependent upon many variables, with continental weather conditions being one of the most impacting factors. Since there is no "best" day or time of day to observe migration, experienced observers spend full days watching for activity.

Document Appendix 21 prepared by Stantec Consulting, Inc. details the raptor survey study for the project. Beginning on page 30, the authors state a raptor survey was conducted in 2007 for 11 days between the dates of September 5 and October 16. Nowhere in the document does it appear the authors cite the specific days that anyone was present and observing raptors, and the document is vague as to the hours of observation, citing "generally conducted from 09:00 to 15:00". Although the protocol for the fall survey

purportedly adheres to that established by Hawk Migration Association of North America, the limited number of survey days was grossly inadequate and the effort not commensurate with HMANA standards and for documenting migrant raptors' using of the project area. At best, we can conclude that Stantec used HMANA data sheets for recording observations.

Despite gross under-sampling of survey days, Stantec draws the following unsubstantiated conclusion: "The overall passage rate of raptors within the Project area was very low relative to other sites. The decreased activity of raptors at the proposed Project decreases the risk of raptor collisions."

Given the gaps in days where no observations were made at all, Stantec cannot be certain the periods of observation corresponded with peak migration. It appears the fall raptor migration study is grossly inadequate and should be expanded for more days and multiple years before any firm conclusions can be draw.

In Appendix C, Table 1 of Appendix 21, Stantec attempts to characterize the project site's importance (or not) as a raptor migration site by comparing it to other sites in Maine, Massachusetts and elsewhere. Raptor counts included in the Stantec report were obtained from the HMANA website and summarized for the period from Sep 5 to Oct 16. These sites had manned observers everyday extending from before Sep 5 and days after Oct 16 with the hours of observation for most days exceeding eight hours a day. Although Stantec tries to draw conclusions of raptor migration from this exercise, its effort is unsupportable even to the most novice hawk watchers.

Finally, given the vagueness of flight patterns year after year, one season of observation, even if adequately conducted, would not prove conclusive. There can be significant differences in hawk counts from one season (e. g. fall) to another at the same migration watch site and between watch sites. It is for this reason that USFWS interim guidelines[1] and other organizations recommend multiple seasons of observation (minimum 3 years by USFWS) from which to draw meaningful information as to the relative importance of a raptor migration watch site. The single season of raptor counts is unacceptable and the methodology employed by Stantec in conducting the raptor survey renders the results essentially meaningless.

In short, the NH SEC, NH State Agencies, and the public have no valid data on which to evaluate the risk to diurnal migratory birds.

**7) What about the potential impact to nocturnal migrants if the project were built?**

[1] Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. http://www.fws.gov/habitatconservation/wind.pdf

I have serious concerns regarding the potential risk to nocturnal migrants, including bats and birds.

At this time, I am awaiting additional documentation on concerns expressed by the US Fish and Wildlife Service (UDFWS) regarding the methodologies employed in conducting the radar surveys and I reserve the right to comment further in supplemental testimony. However, it is clear from a September 16, 2008 letter to the Service that USFWS was not satisfied with the number of seasons of radar surveys. While we are pleased the applicant conducted radar surveys in fall 2006 and 2007, the survey periods fall far short of US Fish and Wildlife recommendations. For 2006, 30 nights were surveyed between Sep 09 to Oct 12, for a total of 328 hours. The 2007 survey was conducted for 29 nights between Sep 5 and Oct 22 and nearly 100 fewer hours (232 hours – Appendix A, Table 1 Fall 2007 Migration Survey). Conducting different levels of effort from one season to the next and on different survey days makes it difficult to draw any meaningful conclusions. It should be noted that 30 days or less represents half the number of days of a realistic migration period, which extends from mid-August through at least the end of October.

Still, despite the limited survey period, the results provide some points of concern.

The 2006 radar survey reported the overall mean passage rate for the period at 469 ± 46 t/km/hr targets per kilometer per hour (t/km/hr). Comparing this passage rate to other fall survey results along forested ridgelines as listed in Table 1 of the Fall 2006 Migration Survey, we find this project site shows one of the *highest* mean passage rates recorded for radar studies conducted for this purpose.

In the conclusion of the 2005 radar survey report, Stantec makes this statement: "The mean passage rate was comparable to passage rates documented at other recent studies in the region, indicating that migration activity over the project is not particularly unique."

Given the variation year over year, and what appears to be a notably high passage rate for the project site in 2006 compared to other surveyed sites, we do not understand Stantec's statement which appears more arbitrary than informative.

The 2007 fall survey found the overall mean passage rate for the period to be 366 ± 27 t/km/hr despite nearly 100 fewer hours of survey. It is not clear from the report why Stantec limited the hours of observation, however, the Figure 2-7 of the Fall 2007 Migration Survey presents some clue and reason for concern. We note on several nights listed in the figure there were high mean passage rates as well as high percentages of migrants flying at or below 125 meters. This could be an indicator of inclement weather or a low cloud ceiling height resulting in the targets flying lower. If poor weather conditions set in quickly, as often happens, particularly at high elevations, the targets will drop flight elevation and run a dangerous risk of collision.

**8) Are there other limitations with the radar surveys which make risk assessment of nocturnal migrants difficult?**

Yes. Acoustical assessments of birds were not conducted at the site, thus we have no understanding of the composition of species migrating over the site. While some species are more common than others, it is important to know whether there are uncommon or rare species that fly over the site, particularly if such an event occurs on a regular basis. We understand that not all species emit sounds as they migrate and thus, cannot be detected. Nonetheless, it is important to capture more information about the identity of the "targets" themselves. In addition, on-site weather patterns are important in comparing variations in bird passage rates and, in particular, to understand the percent of birds reportedly flying below turbine height. No hourly weather data (or other increment) was provided to describe cloud ceiling height, percent cloud cover; wind gusts, speed and direction at ground level and aloft, and similar data for air temperature at the site. This information is important in determining whether there are any differences in migration behavior or flight height during periods of inclement weather. It is important to note that reports of large mortality events associated with other tall structures usually involve periods of severe weather and low cloud ceiling. Unfortunately, radar equipment is usually shut down during these same time periods. Stantec asserts that weather data was collected however it is limited to hourly wind speed and temperature. This assertion does little to assuage the problem indicating that Stantec does not seem to understand the value of such weather information.

The radar reports do not provide us with data (narrative and graphical) which would clearly articulate the volume of airspace that is sampled and the volume of airspace from which data is analyzed. Of equal importance, the reports do not show the volume of airspace at and adjacent to the proposed project that is not sampled, versus sampled but not analyzed. Although Stantec continues to assert in this study, as it has for studies at other sites (Lempster Wind, Deerfield Wind, etc) that "migrants use a broad front migratory path across the Project area, and that areas of concentrated night-migrant density are not likely to occur in the Project area," the fact remains that the reports are insufficient for determining if there is migration channeling occurring along ridgeline due to topographical or other features. This information is important in determining a full risk assessment of the project.

Requests for this data and analysis have consistently been made of Stantec (Woodlot) by State agencies (Vermont Agency for Natural Resources) and the US FWS at other sites in New England where Stantec was contracted to provide a study.

**9) What conclusion would you draw from this information?**

The proposed project may pose a high risk to nocturnal migratory birds. However, Stantec's seasonal surveys were inadequate for the below reasons, and thus provide incomplete information needed to assess risk.

1. The radar surveys were selective in the days and hours sampled.
2. The surveys were conducted for only two fall seasons, 2006 and 2007, but the number of days and hours was not consistent.
3. Failure to report important weather information and adequate volume of air space makes it impossible to verify Stantec's assertions about patterns of migration.

To highlight the possible risk to migratory targets in the project area, it's worth noting the letter included in Exhibit A dated September 20, 2006 from Virginia's Department of Game and Inland Fisheries (VA DGIF) to Joel Peck of the State Corporation Commission regarding risks to wildlife should the Highland New Wind Development LLC facility be approved. The nighttime radar study for that project reported an average passage rate of 385 targets/hour/km, lower than the project's figure (469 t/hr/km), and a mean of 11.5% flying below 125 meters.

While some may argue possible differences in methodology from one study to the next, there is no question VA DGIF was concerned about fatality rates. On page 2 of the letter, it states, "The applicant's data and data from existing wind farms in the Alleghenies provide evidence that there likely will be large fatality rates at this site." It further states on the same page: "*In the absence of studies that compare pre- and post-construction data, we presume a significant positive correlation between passage rates and fatality rates.*"

This statement is consistent with this assertion by Wildlife Biologist Daniel Boone who, in his August 4, 2006 letter to the Maryland Public Service Commission wrote:

> "...using the long-standing practice of evaluating collision risk based on the numbers of birds and bats that pre-construction studies determined would be within the rotor-swept area of a proposed windplant (as is recommended in the USFWS Guidelines and likewise implied in the NWCC "Guidance Document" – see p. 67: "...it may be assumed that the more time a species spends flying at heights encompassed by the rotor swept area of turbines, the more risk the species faces in a wind plant."). The MD Siting Guidelines need to be revised to specify that "the potential for high risk" of collision with wind turbines is directly related to whether large numbers of low-flying birds and bats occur within the project area of a proposed windplant."

In light of potential high risks to migrant targets, we reserve the right to provide in supplemental testimony a list of recommendations for mitigation practices that could minimize risk to birds and bats should this project be approved.

**10) And what of average bat mortality rates at wind facilities in the U.S?**

We are learning more daily about the impacts of wind energy development on bats. Bats in this region must survive at the more northern latitudes of their range in North America. They deal with shorter summers, longer hibernation periods, and cooler, more volatile temperatures. These factors all result in lower bat populations relative to other parts of North America. Because bat numbers may be fewer at our latitude, their populations may be more vulnerable to added mortality factors. Still, bat species do have longer life spans and very low reproductive rates, typically 1-2 pups per litter and only one litter per year (Exhibit A). This makes them particularly vulnerable to other mortality factors.

We still know very little about bats species and populations in New Hampshire and the New England region. Efforts recently with summer mist-netting and acoustical surveys have provided some insight; however there are substantial gaps in our knowledge base.

Bat mortality at wind facilities in the East, on average, has been particularly high especially along forested ridge tops. Only recently have bat experts come to understand that the cause of mortality is not entirely due to collision with the turbines, although collision is a factor. Far greater numbers of bats are dying due to air pressure drops occurring behind the turbine blades resulting in the lungs and blood vessels of animals to quickly expand and burst.

More information is clearly needed to understand the risk of wind energy development to bats.

**11) Were the studies conducted by the applicant sufficient to determine risk to bats?**

In determining risk to bats, as is the case for birds, it is essential to determine the level of bat activity in and around the project site. Stantec conducted an acoustic monitoring survey with Anabat detectors during the summer and fall of 2007. A total of four detectors were deployed, with two sited at one of the met towers and another two at a second met tower located approximately 2+ miles away. Both locations were within the project footprint.

We share the concerns raised by USFWS in April 23, 2008 letter to Joshua Brown of Noble Environmental Power, as follows:

> "Bat acoustic detectors should be deployed at the met towers and at various other locations along the proposed turbine string, including the northern and southern extremities. They should also be deployed in favorable locations in the adjacent valleys, e.g., near streams, ponds, wetlands, and travel corridors to determine if a reservoir of bats and/or bat activity exists in or near the project area.

Also, any suitable breeding habitat for small-footed bats in the project area should be identified and surveyed with acoustic detectors and/or mist nets. We understand that caves may exist on the west side of Mr. Kelsey between Wells and Watkinson Brooks. These should be confirmed and if so, surveyed to determine if they are used as den sites or hibernacula sites and if so, by which species."

In reviewing the Stantec's preconstruction studies daytime and nighttime migrants (including bats), we find a consistent pattern of under-sampling. As a result, it is not possible for the parties to evaluate and confirm the assertions made by Stantec regarding risk.

**12) What are some of the consequences of forest habitat fragmentation at the site?**

We defer to NH Fish and Game testimony regarding habitat fragmentation, however, we note Paul Kerlinger's March 2002 report entitled *An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont* July 1996–July 1998. In the report, Kerlinger states this about fragmentation:

> The potential for negative impacts resulting from habitat modification and presence of turbines should not be taken lightly as forest fragmentation is an important and timely conservation issue among wildlife managers and conservation organizations. The fact that many forest interior species are declining is significant, especially with wind power development being proposed for forested areas of the northeast. The question of interest to conservationists and agency regulators is whether these species can coexist with turbines."

Forest interior habitat, the habitat deep in woodlands and secluded from the influences of forest edges and open space, is becoming increasingly rare. This habitat is now home to certain forest-dependent wildlife that require it to survive. The short, informative document included in Exhibit B entitled "*Conserving the Forest Interior: a Threatened Wildlife Habitat*" explains that for every opening in a forested area, a full 100 meters from the forest's edge inward converts to edge habitat. For the proposed project area, there will be approximately 20 acres of forest interior habitat lost per turbine, not including the impacts of fragmentation due to road development.

**14) Moving on to the project's purpose, do you have any comment on generation from wind?**

The New England region is evaluating its energy needs and taking steps to encourage a diversity of resources to meet demand, including renewable energy. It's fundamental that any generation that gets built be able to contribute to our growing capacity needs in the region. ISO NE's CEO Gordon van Welie stated in 2006 that "Electricity demand throughout New England is growing by the equivalent of one large power plant

every year," and that "as New England's electricity supplies decrease, the price of wholesale electricity will increase and reliability will be threatened."

Wind energy is an intermittent resource that will generate capacity only when the wind is blowing and within a specific speed. If the winds are light, we get little or no generation from the facility. If the winds are gusty with considerable fluctuation within limited intervals (10-15 minutes) the intermittency becomes more pronounced. While traditional sources of electricity generation produce within 5-20% of nameplate capacities, the electricity output for a wind-powered facility and the timing of that output is a function of the local wind profile. The nameplate capacity represents only the maximum production of the generator. The applicant has asserted in its application that the anticipated average capacity factor for the project would be 35% (99MW installed and producing 300,000MWh).

The State of New York conducted a study on wind energy to determine the availability of the resource and whether there were any transmission limitations to building wind in the state[2]. In that report, New York stated that onshore wind could be expected to produce at an effective capacity of 10% "due to both the seasonal and daily patterns of wind generation being largely "out of phase" with the NYISO load patterns". In other words, the ability of the onshore wind resource to reliably contribute capacity during peak periods (summer, mid-afternoon) was only 10%.

The Electric Reliability Council of TX (ERCOT), presented similar conclusions before the Texas legislature in 2005[3] where they said:

> "In addition to meeting the state's energy needs (MWh), the electric system must also meet expected peak demand (MW). Generation resources other than wind will be needed to meet most of the projected growth in peak demand, as maximum output from wind resources does not correspond to system peak demand. ERCOT currently assigns 10% of the installed capacity of wind turbines to its calculation of the ERCOT peak capacity reserve margin. Based on a review of historical data of actual wind turbine generation during ERCOT system peaks (from 4 p.m. to 6 p.m. in July and August), the average output for wind turbines was 16.8% of capacity. However, the data also showed that for any hour during these months, the output of the wind turbines could range from 0% of installed capacity to 49% of installed capacity. Stakeholders comprising the ERCOT Generation Adequacy Task Group have expressed concern that use of an average number (i.e., 16.8%) was too optimistic because it fails to adequately recognize the intermittency of wind generation. Accordingly, the group is working to assign a peak capacity value for wind using an appropriate "confidence factor." While the group has not yet formally made a recommendation to the ERCOT Technical

[2] http://www.nyserda.org/publications/wind_integration_report.pdf

[3] http://www.ercot.com/news/presentations/2006/RenewablesTransmissi.pdf

Advisory Committee, it is currently considering recommending a wind capacity value of 2%. In summary, in order to reliably meet system peak demand, dispatchable resources (such as gas, coal, biomass) would be required to replace the wind resources when wind is not blowing."

The ISO NE, in its Stakeholder Scenario Planning initiated last fall, has expressed uncertainty as to the effective capacity to assign wind on the grid. For the scenario process, the ISO set the figure at 20% and will be evaluating wind data in the region to validate this assumption. While the applicant has asserted the project will generate at 35% capacity on average, this does not tell the ISO, or the NH SEC, how much generation the public can reliably expect from the facility during periods of peak demand.

While the applicant has stated average capacity anticipated from the project, the submitted information does not attempt to prove this point. Nowhere in the application are the wind characteristics at the project site qualified. How often does the wind blow? when does it blow (time of day, time of year)? at what speeds? and at what variability? These are all basic questions to be answered before the true benefit of the project can be determined and whether that benefit outweighs attendant impacts.

**15) Regardless the capacity figure, isn't it enough that this renewable project will generate emission-free energy thus displacing generation from traditional fuel sources? In other words, isn't 1 MWh of wind generation 1 less MWh of fossil fuel generation?**

Looking at wind generation in isolation and not considering the time of day and time of year of the generation, or the other power facilities on the grid at the time the wind was blowing, presents an overly simplistic and inaccurate description of how the grid operates. While wind generation can offset fossil fuel use, which here in New England is likely natural gas, and perhaps hydro, any emission reduction would need to be evaluated in the context of the New England grid system. The sum reduction (or offset) in greenhouse gases should this wind project proceed is not a certainty.

Further to that point, New Hampshire is participating in the Regional Greenhouse Gas Initiative (RGGI), which provides for the cap and trade of greenhouse gas emissions. In this regime, emissions are displaced, but not avoided.

**16) Will building this project enable New England to avoid having to build other power facilities to meet energy demand?**

Since wind is an intermittent and unpredictable generator, the firm capacity it can supply to the grid is inherently limited, and will not eliminate the need to build more reliable forms of generation in the region. In other words, if we build wind turbines and accept their attendant impacts, it will still be necessary to build

more substantial generation, whether it be renewables (biomass, land fill gas, small hydro, and even solar which can produce during peak demand), or more traditional generation (nuclear, natural gas, clean coal technology).

The ISO NE 2006 Regional System Plan (RSP06) was very clear (pg 5) in stating: "Without adding new resources to the system, the frequency and severity of responding to a capacity deficiency would increase over time and vary with changes in demand and other factors." Using the ISO's 20% figure (still an assumption to be validated) the proposed project can be expected to produce only 21.78MW, representing 0.077% of the New England grid's peak demand reached on August 2, 2006 (28,127 MW). Given the enormity of the project footprint, the risk to the natural environment, it is essential that we weigh whether the generation potential is worth the impacts.

It's worth noting that the RSP06 also makes this point: "Locating generators near areas of relatively high demand provides the capacity needed to meet demand while minimizing the need for transmission expansion." Since onshore wind energy projects must be built at the wind resource, in New England, this typically means siting the facilities far from the demand centers.

**17) Do you have any comments regarding the noise modeling conducted by the applicant?**

Yes. According to document Appendix 28 of the application, the applicant states "Modeling was completed for the project using Cadna A acoustical modeling software. Made by Datakustik GmbH, Cadna A is an internationally accepted acoustical model, used by many other noise control professionals in the United States and abroad."

While we do not dispute this fact, the applicant fails to note that the Cadna A software suitable for evaluating ground-based noise sources and that increased operation sound pressure levels above the predictive model may occur due to the hub level to surface wind potential disparities, as well as increased atmospheric refraction above the predictive model. The Cadna A modeling software – as based on the ISO 9613-2[4] standard -- does not appropriately account for the refraction and reflection effects of the sound at elevated noise sources. It is difficult to determine what level of confidence the NH SEC, State agencies, or the public can place on the preconstruction predictive sound levels.

Further to this point, the ISO 9613-2 standard does not comprehend a modeled receptor located beyond 1000 meters from the modeled noise source, further putting into question the validity of the applicant's

[4] ISO. 1996. Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation. International Organization of Standardization. ISO 9613-2. p. 18.

modeled results. According to Appendix 28, the modeled receptors were located more than one mile away from the proposed turbine locations.

We were unable to find any information in Appendix 28 or in David Hessler's testimony acknowledging the limitations of the Cadna A modeling software or providing any information on expected error rates applied to the results based his use of the model which exceeds published limits.

**18) Do you have concerns pertaining to assumptions made in the noise study?**

Yes. On page 3 of 5 (ln 16) of his prefiled direct testimony, Mr. Hessler asserts "During calm and quiet times the Project is not operating, therefore background sound levels for wind projects must be determined as a function of wind speed because the turbines only generate noise of any significance when the wind is blowing." Frankly, we are surprised at Mr. Hessler's statement as it is flatly incorrect. In fact, a frequent nighttime condition where the atmosphere is stable can result in the wind turbines operating at full or near full power and noise output while the wind at ground level is calm and the background noise level is low. This is the condition of maximum turbine noise impact on people nearby and the condition which most directly causes chronic sleep disruption. Taking noise measurements at the ground level with wind noise and making the assumption that wind noise will mask the sound the operating turbines will result in inappropriately inflated background noise levels. Pre-construction noise estimates cannot rely on the assumption that turbine noise will be masked by ground level wind noise[5].

**19) The application asserts that "windparks have been shown to have no adverse impact on property values" and includes the REPP and Hoen reports as justification (Appendices 30a and 30b respectively). Do you have any comments regarding this assertion and the studies cited?**

Yes. We are surprised that the applicant highlighted the 2003 REPP report as this report has been widely discredited and for good reason. We need only look to the Hoen report (Appendix 30b), also cited by the applicant to see the gross errors in methodology followed by the REPP authors. Quoting from the Hoen report, the REPP methodology fails on four counts rendering the results of the report, according to Ben Hoen, "extremely weak, if not entirely misleading". Three of Hoen's criticisms of the REPP report are quoted below:

1) The authors attempt to calculate a value for the variable "view of windmills," without properly controlling for it. There is no attempt to discern which properties within the ten different 5-mile viewsheds can see the windfarm or not. In effect, the study makes the erroneous assumption that all

[5] G.P. van den Berg, "The Sounds of High Winds – the effect of atmospheric stability on wind turbine sound and microphone noise," Ph.D. thesis, 2006

properties in the 5-mile radii can see the windfarm, when many houses' views in fact are obstructed by geological features, trees, and other houses.

2) The analysis does not control for distance to the turbines, thereby making the assumption that the "viewshed" effect is the same, on average, for homes five miles from the windfarm and those in immediate proximity to the turbines.

3) The REPP research is often criticized because "no attempt is made to sort out inappropriate transactions. Sales that are not arms-length (divorce, sales between family members, estate sales etc.) are included. By doing so the report includes transactions that do not represent the agreement between a willing buyer and a willing seller, a requirement for accurate analysis."

With regard to the Hoen report, Ben Hoen makes clear in his own report that "To the degree that other similar communities exist in the US, in that they have similar land uses, median home prices, and homeowner profiles, these results should be transferable. Extrapolation of these results to communities which do not fit this description, without careful consideration, is not recommended until more research is conducted." We could find no where in the application where the project proponent attempts to compare the project site and surrounding communities and landscape to that of Madison County, NY.

In effect, the applicant has provided no meaningful or verifiable argument on whether the project site will have a negative (or positive) impact on property values.

**19) Are there any further comments you would like to make at this time?**

No, however, I reserve the opportunity to comment further on decommissioning of the facility, impacts to the natural environment, and the health and safety risks in my supplemental testimony as information is available.

**20) Does this complete your pre-filed testimony?**

Yes.

**EXHIBIT A: Virginia Department of Game and Inland Fisheries Letter**

# COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
*Secretary of Natural Resources*

***Department of Game and Inland Fisheries***

Colonel W. Gerald Massengill
*Interim Director*

September 20, 2006

Joel Peck, Clerk
State Corporation Commission
Commonwealth of Virginia
Tyler Building
1300 East Main St.
Richmond, VA 23219

RE: Highland New Wind Development, LLC
Case No. PUE-2005-00101
ESSLOG 19301

Dear Mr. Peck,

This letter is provided as a supplement to the Department of Environmental Quality's (DEQ's) report of June 30, 2006, as a supplement to our February 24, 2006 and May 24, 2006 letters and May 3, 2006 email (Attachments C, D, and E respectively), and as a response to the August 4, 2006 legal memorandum from the Highland New Wind Development, LLC project applicant. The Department of Game and Inland Fisheries (DGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises management and regulatory jurisdiction over those resources, inclusive of state or federal Endangered or Threatened species, but excluding listed insects.

We support the use of alternative energy sources, including wind energy. However, based on our review of the information provided thus far by the Highland project applicant, in the absence of accountable mitigation conditions (discussed below and in Attachment A), we feel this project presents an unacceptable risk to wildlife. We are particularly concerned with potential significant adverse impacts upon bats and birds. This is due, in part, to the project's location relative to caves that support large numbers of bats (200,000+), including Endangered and Threatened species, the high passage rates of bats and birds identified by the onsite radar study conducted in the fall of 2005 (Plissner et al. 2006), the significant bat fatality rates at other Allegheny wind farms, and the documented use of ridge tops by eagles.

We have several key issues concerning this project, should it be licensed: 1) the precedent that will be established for future wind projects; 2) the high potential for significant mortality of bats (both local and migratory populations, including Endangered and Threatened species) and birds (particularly eagles); and 3) the importance of rigorous mitigation measures in conjunction with long-term monitoring. These issues are further explained below and in the attachments.

1) Precedent. This project, and the conditions imposed by the SCC, will set a precedent for all future wind energy projects in Virginia. Wind farms cannot be viewed as independent with regard to impacts upon wide-ranging migratory animals. We currently lack sufficient knowledge to absolutely determine the maximum fatality rates that can be tolerated at a given site without unacceptably impacting local or regional populations of sensitive species; but we are certain that high fatality rates at multiple sites across the landscape would pose an unacceptable risk, as do unmitigated fatalities of Endangered or Threatened species. If this project is permitted, then standard pre- and post-construction monitoring and mitigation conditions need to be implemented in accordance with our recommendations (presented below and in Attachment A). As the Commonwealth's wildlife agency, it is our responsibility to conserve those resources for the benefit of all citizens. In the case of this project, where wildlife losses potentially could be very substantial and significant, we must take a conservative approach to assessing risk and designing appropriate mitigation. The data needs for pre- and post-construction evaluation, monitoring, and mitigation should not be dictated by project applicants or consultants; but rather should be developed by the agencies that are responsible for managing Virginia's wildlife resources and wind energy development program. These agencies will bear the responsibility to apply these standards consistently from project to project, and to address concerns expressed by citizens of the Commonwealth regarding protection and management of Virginia's wildlife resources.

2) Fatality Rates. The applicant's data and data from existing wind farms in the Alleghenies provide evidence that there likely will be large fatality rates at this site. The radar study conducted by ABR, Inc. in the fall of 2005 (Plissner et al. 2006) documented passage rates that "were much higher than those at other locations in the eastern U.S. where we have conducted fall migration studies with similar equipment and methods" (Plissner et al. 2006). In addition, ABR, Inc. documented passage rates below the proposed turbine height that "were higher than those calculated at other sites in the eastern U.S." In the applicant's August 4 memorandum, he has presented tables showing passage rates even higher than those observed by ABR. These data substantiate our concerns regarding the Highland project, and reinforce our concern about the cumulative impacts of multiple projects.

In the absence of studies that compare pre- and post-construction data, we presume a significant positive correlation between passage rates and fatality rates. If this project is licensed including the mitigation and monitoring conditions we request, Virginia will be among the first states to conditionally relate pre- and post-construction surveys to predicted and documented fatalities. In addition, these data will facilitate design and implementation of measures to minimize fatalities, and enable preliminary risk assessment for future wind energy sites in Virginia.

High fatality rates at this site would particularly be devastating to bats because of their reproductive strategy, which is atypical of a small mammal. Most small mammals have developed a reproductive strategy of high productivity, large litters, and multiple litters per year. The tradeoff with this characteristic is that most small mammals are short lived (typically 1-2 years). Bats, though, are at the opposite end of the spectrum. They have small litters (typically

one or two young), only one litter per year, and life expectancy of 12-15 years. With this strategy, the impact of the loss of individuals is much greater, especially within small populations.

Considering the U.S. Department of Energy objective to generate 5 percent of the U.S. electricity needs via wind power by the year 2020, along with federal subsidies promoting wind power, we are assured a substantial increase in wind farm proposals for the Appalachians. The high fatality rates documented at existing wind farms in the Alleghenies are strong evidence foretelling high fatality rates in Highland County. The fall 2005 radar study conducted by the applicant confirms this. Therefore, if the SCC permits this project without appropriate mitigation and monitoring conditions (as outlined below and in Attachment A), then we anticipate significant resultant mortality of bat populations in Virginia and the Appalachians.

In addition to bats, we are concerned over potential eagle fatalities at this site. The high number of bald eagles and golden eagles observed in Highland County, compared to other parts of the Alleghenies, and their use of ridges warrants this concern. The applicant's consultants have opined that "if it isn't happening at other sites, then it won't happen here." To transpose that argument, however, if that premise were true, then the large bat fatality rates documented (by the applicant's consultants) in the Alleghenies should never have occurred, because they had not occurred at other wind energy sites across the nation. Unless we monitor pre-construction eagle activity, we will be unable to relate such raptor use to post-construction raptor use and mortality.

3) Monitoring and Mitigation. If this project is permitted, then appropriate mitigation and monitoring conditions are essential to assess and minimize fatalities. Proper scientifically based monitoring is needed to confidently assess and correlate targets passing through the project area with fatalities caused by the project. This monitoring also should attempt to correlate passage and fatality rates with site conditions. The mitigation plan should include a modified operation schedule (e.g., adjustments to cut-in speed and/or shut-down of turbines during peak migration periods), modified equipment, possible use of deterrents, and/or other measures that will avoid or minimize mortality; and should be implemented concurrently with project approval. In Attachment A, we describe the components of appropriate monitoring and mitigation conditions.

**Comments on Threatened and Endangered species**

We have recommended that the applicant consult with the U.S. Fish and Wildlife Service (USFWS) concerning potential take of federal Endangered or Threatened species. We cannot authorize take of federally listed species. The applicant's consultants have downplayed the potential for such take but, in our opinion, the evidence suggests a strong likelihood of take. Proximity of the project to the largest Indiana bat and Virginia big-eared bat colonies in the region, and reported substantial occurrence of bald eagles in the area, suggest great likelihood of take of a federal listed species. While no mortality of Endangered or Threatened bat species has been observed at a wind facility, the applicant should not assume that such an event has not occurred: indeed, there are few data on bat mortality at wind facilities. The work conducted at the Mountaineer and Meyersdale projects covered a short timeframe and demonstrated that only

a small percentage of the dead bats were recovered; a larger percentage were missed by observers or removed by scavengers. Thus, if an Endangered or Threatened bat were killed, it is likely the carcass would not be recovered. At the Mountaineer site, all bat species known from the area, except the three rarest ones, were found dead at the site. There is no reason to assume that the rare species were less likely to be killed than the common species, and these same species are present in the vicinity of the Highland project. We again recommend that the applicant consult with the USFWS concerning potential take of federally listed Endangered or Threatened species at the project site.

**Comments on other wildlife resources**

On July 25, 2006, we conducted a field visit to assess suitability of the site to provide habitat for Federal Endangered/State Endangered northern flying squirrels, State Endangered rock voles, and State Endangered water shrews. Based on this visit, as long as construction impacts remain within the existing cleared ridges and access roads, we agree that construction of this project should not impact northern flying squirrels. However, suitable northern flying squirrel habitat does exist along the margins of the impact area as described above. Similarly, while suitable habitat for water shrews and rock voles does exist onsite, as long as the proposed utility line and stream crossings occur within the existing cleared powerline easement, and as long as the crossings are directionally drilled (see below) with adequate setbacks, we do not anticipate a significant adverse impact upon those species due to this project.

We remain concerned about potential adverse impacts upon native trout resources within Laurel Fork. According to the applicant's Joint Permit Application, submitted to the Virginia Marine Resources Commission (VMRC), this project will include three utility line crossings of Laurel Fork and two unnamed tributaries to Laurel Fork. These crossings are proposed to be directionally drilled. However, the application states that the crossings will include equipment pits excavated approximately 6 feet from both banks of the streams. These pits will be approximately 9 ft wide, 15 ft long, and at least 4 ft below the streambed. Our concern is that this construction activity has a high potential to result in sedimentation of the streams and adverse impacts upon trout. Therefore, in our comments to the VMRC (Attachment E), we recommended increasing the setback of these equipment pits to at least 50 ft and implementation of strict erosion and sediment control measures. These measures should include installation of silt fences and hay bales, timber mats in all travel lanes, and use of frac tanks and filter bags to manage any water that enters the pits. During the site visit, the applicant stated that the pits would be excavated further from the stream, possibly at least 20-30 ft. We request an updated construction plan that reflects our concerns and the changes described by the applicant.

In Attachment B, we provide additional comments specifically in response to the legal memorandum dated August 4, 2006 from the Highland New Wind Development, LLC project applicant.

To reiterate, if the SCC chooses to license this project, we request adherence to the monitoring and mitigation recommendations described in this letter and attachments. In the absence of such

conditions, we feel this project would pose an unacceptable risk to the Commonwealth's wildlife resources.

Thank you for the opportunity to provide additional comments on this project. Please contact Andrew Zadnik at (804) 367-2733 if we can be of further assistance.

Sincerely,

Raymond T. Fernald, Manager
Nongame and Environmental Programs

Cc w/encl. Michael Murphy, VDEQ
Kim Marbain, USFWS
Rene Hypes, VDCR-DNH

**Literature cited**

Arnett, E. B. and J. P. Hayes. 2006. An evaluation of the use of acoustic monitoring to predict bat fatality at a proposed wind facility in south-central Pennsylvania. Unpublished report to the Bats and Wind Energy Cooperative.

North East Ecological Services. 2006. Study proposal for bat migratory and summer foraging survey Highland New Wind Power Project. Submitted to Highland New Wind Development, L.L.C., Harrisonburg, VA.

Plissner, J. H., T. J. Mabee, and B. A. Cooper. 2006. A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC., Harrisonburg, VA.

Reynolds, D. S. In press. Monitoring the potential impact of a wind development site on bats in the northeast. Journal of Wildlife Management.

**EXHIBIT B: Conserving the Forest Interior (Ontario Extension Notes)**

# EXTENSION NOTES

Ontario

# CONSERVING THE FOREST INTERIOR: A THREATENED WILDLIFE HABITAT

Only 200 years ago forests stretched nearly continuously across southern and eastern Ontario. The uplands were shaded by trees of all sizes, ages and successional stages. Natural openings were rare, irregular breaks in the leafy canopy. Today, the picture is very different. Forests now cover only about 20 per cent of land — one in five hectares — south and east of the Canadian Shield. This ranges from a high of 30 per cent — one in three hectares — in eastern Ontario, to a low of about three per cent forest cover in extreme southwestern Ontario. While we strive to manage the remaining woodlands sustainably, some wildlife populations struggle to adjust to the loss and fragmentation of forests.

Landowners are stewards of a great deal of forest habitat in southern Ontario. But these forests are broken into thousands of small woodlands ringed by roads, highways, farms, fields and rural and urban developments. Small, fragmented forests still sustain wildlife and produce wood fiber, but they often lack a high-quality habitat called the forest interior. The conservation values of this "deep woods" habitat warrant a closer look for woodland planning and management.

This Extension Note introduces you to the forest interior and the wildlife species that depend on this threatened habitat. It provides ideas on how landowners, conservation agencies and interested groups can protect and improve forest interior conditions in the fragmented forests of southern Ontario.

## WHAT IS FOREST INTERIOR HABITAT?

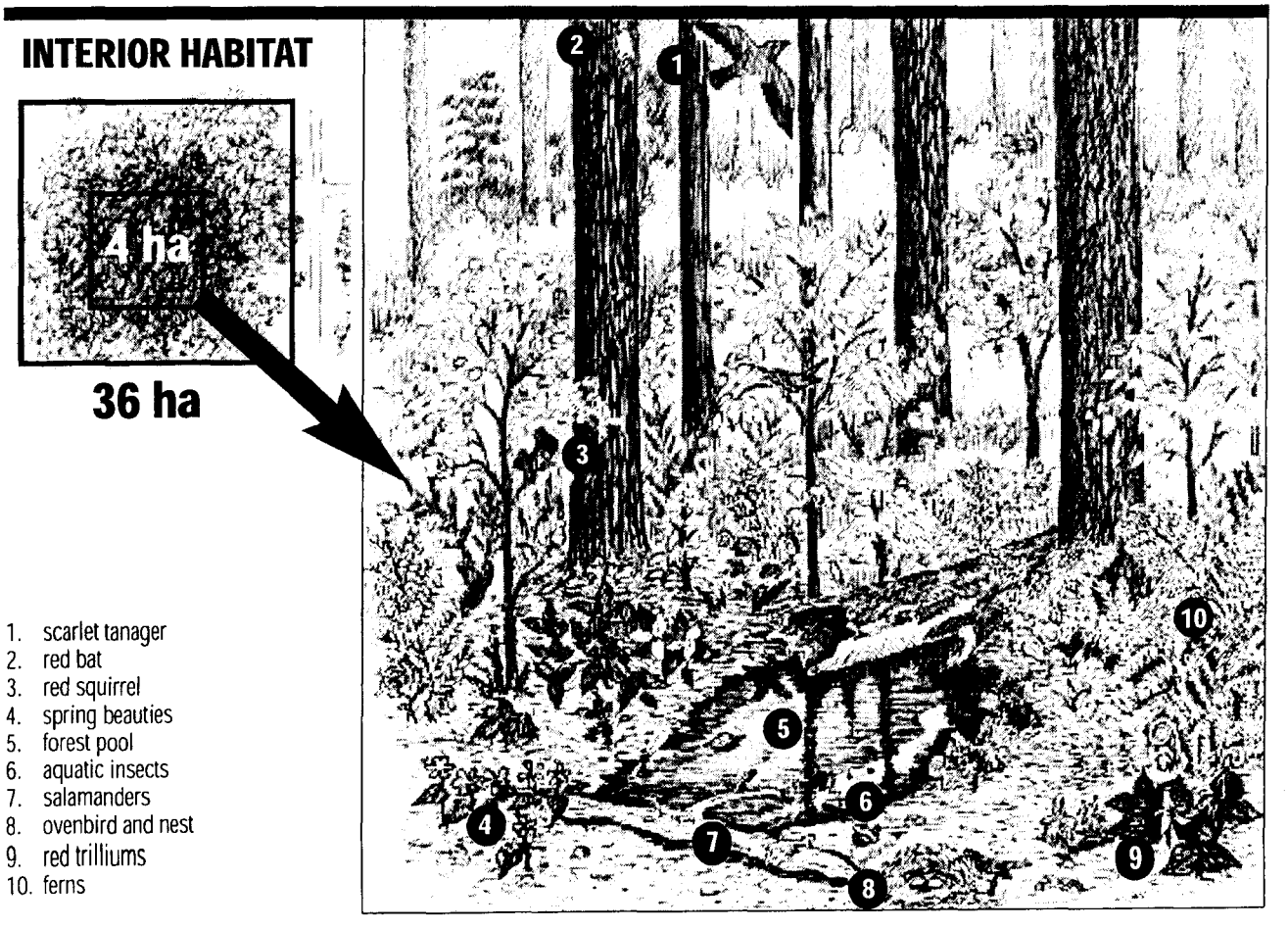
The *forest interior* is habitat deep within woodlands. It is a sheltered, secluded environment away from the influence of forest edges and open habitats. Some people call it the "core" or the "heart" of a woodland. The presence of forest interior is a good sign of woodland health, and is directly related to the woodland's size and shape. Large woodlands with round or square outlines have the greatest amount of forest interior. Small, narrow woodlands may have no forest interior conditions at all.

Forest interior habitat is a remnant natural environment, reminiscent of the extensive, continuous forests of the past. This increasingly rare forest habitat is now a refuge for certain forest-dependent wildlife; they simply must have it to survive and thrive in a fragmented forest landscape.

## HOW IS EDGE HABITAT DIFFERENT FROM FOREST INTERIOR HABITAT?

Woodland edges are sunnier, warmer, windier, drier and experience more dramatic environmental changes than the forest interior. Edge habitats are also more prone to disturbance and support a larger variety and higher density of predators.

Wind and sun dry out forest edges, reducing the diversity and abundance of insects and other invertebrates that are important foods for wildlife that depend on forest interior habitat. Forest pools near edges tend to dry up, eliminating vital water sources for wildlife and habitat for aquatic insects, which are critical food sources for many birds and amphibians. The pools are also critical breeding habitat for amphibians such as frogs, toads, and salamanders. "See-through" woodlands may be made up entirely of edge habitats, where winds bring in air pollution, diseases and seeds of non-native plant species. Invasive plants such as garlic mustard and glossy buckthorn may take over the forest floor of small fragmented woodlands. Forest edges are also more exposed to blowdown, noise pollution, motorized vehicles, vegetation clearing and urban development.



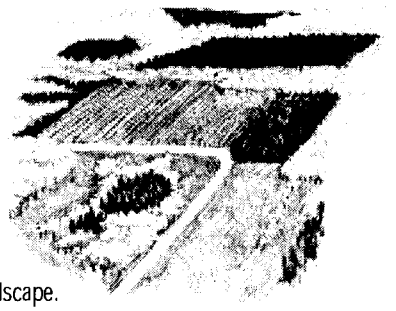

1. scarlet tanager
2. red bat
3. red squirrel
4. spring beauties
5. forest pool
6. aquatic insects
7. salamanders
8. ovenbird and nest
9. red trilliums
10. ferns

## HOW DOES FOREST FRAGMENTATION AFFECT WILDLIFE?

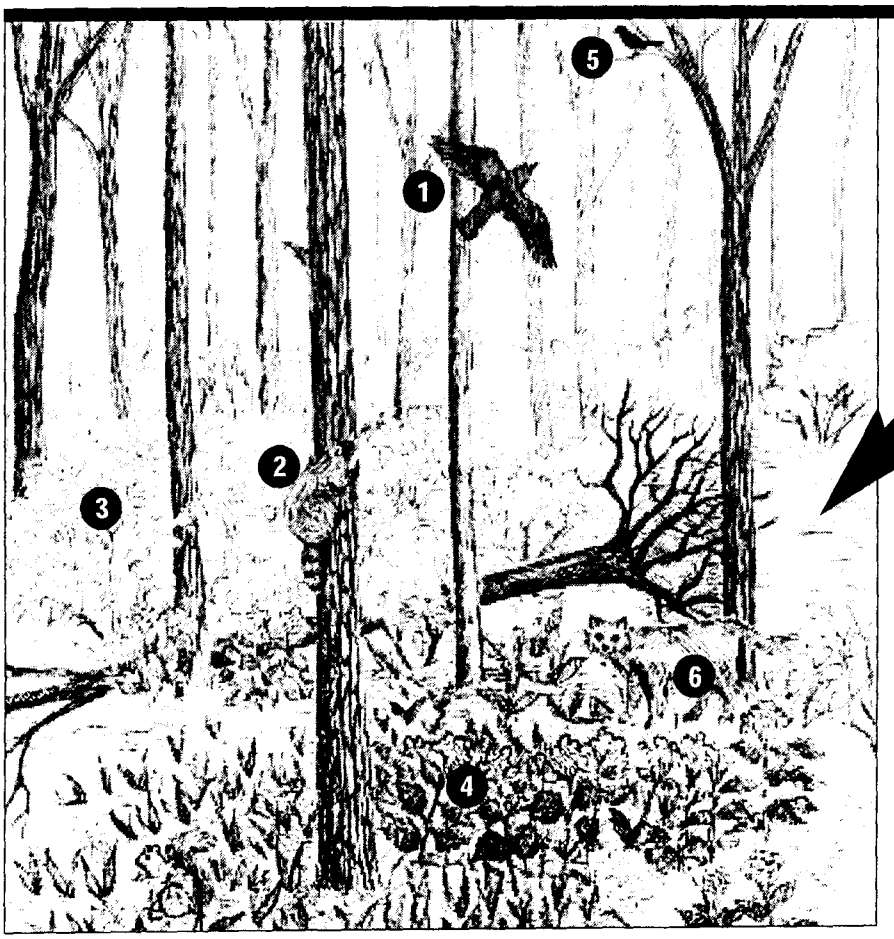
Experts believe that formerly continuous forested landscapes cannot sustain the natural diversity of plants and animals unless at least 25 to 30 per cent of the land is in forest or other natural cover. Fragmented woodlands — "islands of habitat," as they are called — may simply be too small for some creatures, such as the fisher or red-shouldered hawk. Small isolated wildlife populations often have fewer young per pair, die at a younger age and have less genetic variability than populations of the same species that are not isolated. Small populations are also more likely to suffer declines due to disease, insect outbreaks or periodic weather events. These conditions create a recipe for long-term extinction.

Small forests support small numbers of wildlife. Some species are "area-sensitive" and tend not to inhabit small woodlands, regardless of forest interior conditions. Fragmented habitat also isolates local populations, especially small mammals, amphibians and reptiles with limited mobility. This reduces the healthy mixing of genetic traits that helps populations survive over the long run.

Bigger forests often provide a different type of habitat. Many forest birds breed far more successfully in larger forests than they do in smaller woodlots and some rely heavily on forest interior conditions. Populations are often healthier in regions with more forest cover and where forest fragments are grouped closely together or connected by corridors of natural habitat. The population size and number of young produced by forest bird populations are among the best indicators of forest interior conditions in a woodland. But as ecological research continues, we learn more about wildlife of the forest interior. Eastern red bats, for example, prefer to forage in forested areas and roost high in the foliage of large trees. Biologists have recently discovered that red bat roost trees, on average, are located almost 300 metres from a forest edge.



Typical fragmented landscape.




1. American robin
2. raccoon
3. glossy buckthorn
4. garlic mustard
5. brown-headed cowbird
6. domestic cat

## WHY DO SOME FOREST BIRDS PREFER THE FOREST INTERIOR?

Each forest bird needs a particular type and arrangement of food, water, shelter and suitable nesting sites. Birds like robins, thrashers and cardinals find these habitat requirements at forest edges. Birds of the forest interior seek a different environment. They may actually avoid edges or have poor foraging and nesting success at edges. They find more of their preferred food (particularly insects on the ground and on foliage) deeper in the woods, as well as increased moisture, less nest disruption and fewer predators. These birds are better suited to larger forests in part because of the diversity of microhabitats such as small conifer stands, wet pockets of lowland hardwoods or rare vegetation that are mixed in with common woodland habitats. The variety contributes to greater species diversity and provides a greater variety of potential foods.

Predators of birds and nests, such as raccoons, opossums, common grackles, common crows, and grey squirrels, and domestic and feral cats, all frequent the rural and suburban environments around the forest edge. Biologists have found that 8 out of 10 nests of neotropical migrant birds in small woodlands (less than 100 hectares) may be lost to predators.

Many forest interior birds, such as the ovenbird and the hooded warbler, are ground-nesters or nest in low shrubs, making them especially susceptible to predators and disturbance. Nests laid in the deep forest interior have far lower, more "natural" predation rates.

Nests laid in the forest interior are also less susceptible to brown-headed cowbirds, a brood parasite that lays its eggs in other birds' nests. Cowbirds look for active nests at the edge of forests and in forest clearings. In most cases the host bird actually raises the young cowbirds. Cowbirds grow more quickly than the young of the host species, so nestlings of the host bird may grow more slowly, die in the nest or may even be bumped out of the nest. Three out of four nests of forest birds in small woodlands may be "parasitized" in this way by cowbirds. Cowbirds prefer edges and open areas and avoid larger, mature woodlots where the upper branches of trees form a closed canopy.

Simply put, life for forest birds is more dangerous at the edge.

## A TYPICAL FRAGMENTED LANDSCAPE

Forest interior conditions are extremely rare in the fragmented forest landscape of southern Ontario. This is the breakdown for two reasonably wooded regions of southern Ontario.

| | | |
|---|---|---|
| **Location** | ▶ Eastern Ontario: United Counties of Leeds & Grenville[1] | ▶ Southwestern Ontario: Lake Erie shoreline north to Woodstock and Six Nations Reserve[2] |
| **Total area** | ▶ 359,429 ha | ▶ 360,000 ha |
| **Total forest cover** | ▶ 139,664 (39 per cent of the land) | ▶ 68,282 ha (19 per cent of the land) |
| **Number of woodlands** | ▶ 8,537 fragmented woodlands | ▶ 11,064 fragmented woodlands |
| **Woodlands greater than 100 ha (250 acres)** | ▶ 256 (3 per cent of woodlands were large) | ▶ 98 (1 per cent of woodlands were large) |
| **Woodlands less than 100 ha (250 acres)** | ▶ 8,281 (97 per cent of woodlands are small) | ▶ 10,965 (99 per cent of woodlands are small) |
| **Woodlands less than 3 ha (7 acres)** | ▶ 6,208 (73 per cent of woodlands are very small) | ▶ 8,912 (80 per cent of woodlands are very small) |
| **Average woodland size** | ▶ 16 ha (40 acres) | ▶ Average woodland size 6 ha (15 acres) |

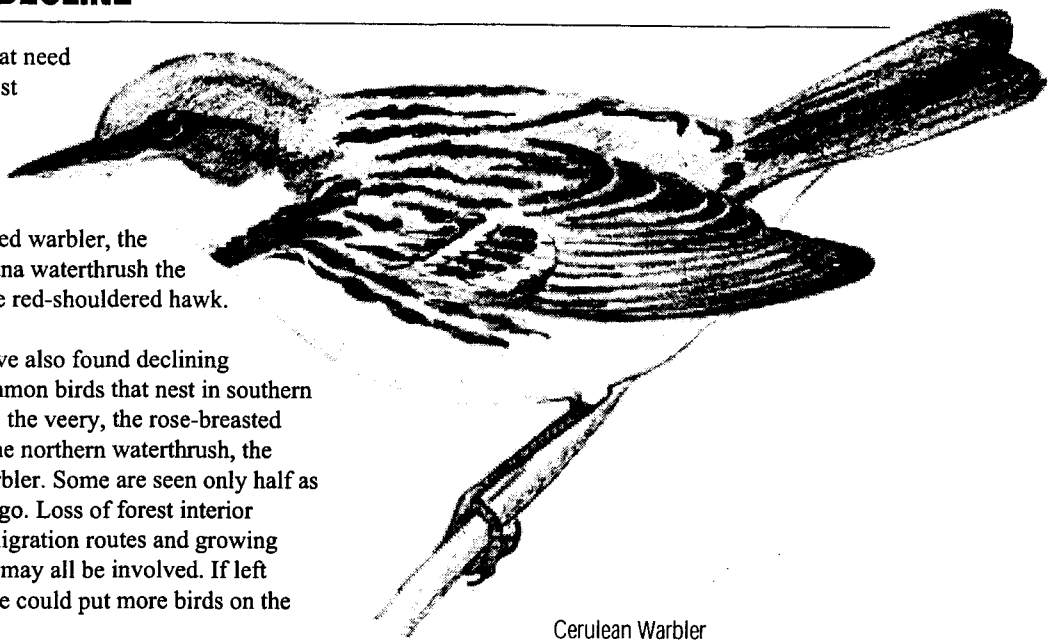
[1] Eastern Ontario Model Forest

[2] Pearce, C.M. 1993. *Coping with Forest Fragmentation in Southwestern Ontario.* In: *Size and Integrity Standards for Natural Heritage Areas in Ontario.* Proceedings of a Seminar. Parks and Natural Heritage Policy Branch, Ontario Ministry of Natural Resources, Hunstsville, Ontario.

## FOREST BIRDS IN DECLINE

Several forest bird species that need large forest areas — and forest interior conditions — have been included on Canada's national list of species at risk. These include the Acadian flycatcher, the hooded warbler, the cerulean warbler, the Louisiana waterthrush the prothonotary warbler, and the red-shouldered hawk.

In recent years, biologists have also found declining numbers of several quite common birds that nest in southern Ontario forests. They include the veery, the rose-breasted grosbeak, the wood thrush, the northern waterthrush, the ovenbird and the Canada warbler. Some are seen only half as often as they were 30 years ago. Loss of forest interior habitat, habitat removal on migration routes and growing threats on wintering grounds may all be involved. If left unchecked, declines like these could put more birds on the endangered species list.



Cerulean Warbler

### EXAMPLES OF BIRDS OF THE INTERIOR AND OF THE EDGE —
**HABITAT PREFERENCES OF SOME BIRDS OF FRAGMENTED FOREST LANDSCAPES IN SOUTHERN ONTARIO**

| BIRDS OF LARGE WOODLANDS WITH FOREST INTERIOR | BIRDS OF LARGE WOODLANDS THAT MAY ALSO NEST NEAR EDGE | BIRDS OF SMALL WOODLANDS OR EDGE HABITATS |
|---|---|---|
| Barred Owl | Ruffed Grouse | Northern Bobwhite |
| Pileated Woodpecker* | Wild Turkey | Red-tailed Hawk |
| Hairy Woodpecker* | Red-shouldered Hawk | Great Horned Owl |
| Acadian Flycatcher* | Yellow-bellied Sapsucker | Mourning Dove |
| Veery* | Red-bellied Woodpecker | Red-headed Woodpecker |
| Hermit Thrush* | Least Flycatcher* | Northern Flicker |
| Swainson's Thrush | Great Crested Flycatcher | Eastern Kingbird |
| Black and White Warbler* | Eastern Wood-Pewee | Blue Jay |
| Black-throated Green Warbler | Black-capped Chickadee | American Crow |
| Black-throated Blue Warbler* | House Wren | American Robin |
| Cerulean Warbler* | Blue-gray Gnatcatcher* | Cedar Waxwing |
| Blackburnian Warbler* | Gray Catbird | Brown-headed Cowbird |
| Mourning Warbler* | Northern Mockingbird* | Common Grackle |
| Canada Warbler* | Wood Thrush | European Starling |
| Ovenbird* | Red-eyed Vireo | House Sparrow |
| Louisiana Waterthrush* | Northern Parula* | White-throated Sparrow |
| Northern Waterthrush* | Rufous-sided Towhee | |
| Scarlet Tanager* | Rose-breasted Grosbeak | |

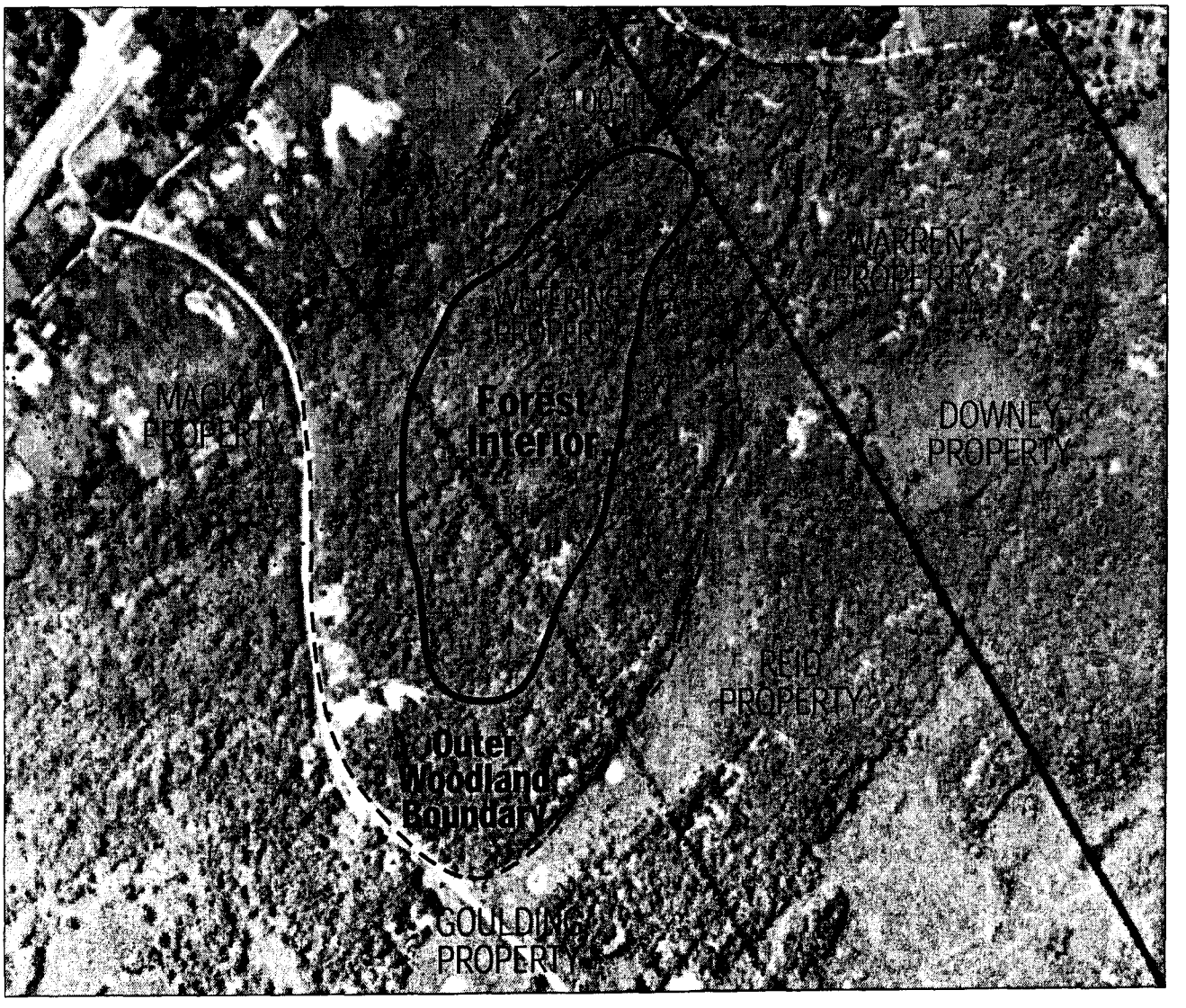
*Primary Source: Freemark, Kathryn. 1999. Area sensitivity and thresholds for birds in fragmented hardwood forests. Canadian Wildlife Service, Hull Quebec. This is a review of over 30 studies in the NE US and Canada. Asterisks (*) indicate birds that are known to decline significantly when forest habitat area is reduced.*

## HOW DO I KNOW IF MY WOODLAND HAS FOREST INTERIOR?

Biologists may occasionally measure or pace into woodlands to determine the amount of forest interior habitat but are more likely to use satellite images and computer calculations. Landowners can use simple measurements, maps or air photos to search for forest interior themselves. Alternatively, the presence and, especially, successful nesting of forest interior species (listed in the table on the previous page) can indicate that a forest provides important forest interior habitat.

Find your property on a map and then use pencil to outline the edge of the entire woodland of interest. Estimate the amount of forest interior by drawing a line 100 metres in from the woodland edge or from any human-created opening such as a field, road, railway line or hydro right-of-way. The scale around the edge of the map will tell you how much 100 metres is on your map. Ontario Base Maps, Forest Resource Inventory maps and aerial photos, available through the Ministry of Natural Resources, are most useful because they are usually more recent than topographic maps. Most are at the same scale, making 100 metres roughly 1 cm on the map or photo.

After drawing the lines from each edge, the area inside the 100 metre limit is your forest interior. Every 1 cm x 1 cm square inside the 100 metre limit equals one hectare. If you have 40–100 hectares or more, you (and your neighbours) have a woodland with valuable forest habitat. You next step could be to look for plants and animals of the forest interior.




Use an air photo to determine the amount of forest interior your woodland provides.

# HOW CAN I CONSERVE FOREST INTERIOR HABITAT?

### 1. HELP PROTECT THE LARGEST WOODLANDS

Large forested areas that are greater than 200 hectares have the most interior habitat. These "mega-woodlands" are very rare in southern Ontario but are vital to the protection and eventual recovery of threatened forest wildlife. Large woodlands support larger and more stable populations of all forest wildlife, and are your best bet for protecting typical forest birds. Woodlands greater than 200 hectares are particularly valuable, but woodlands in the 100 hectare range may still harbour most of the typical community of forest birds. Larger woodlands have greater ecological health and may have greater growth rates and productivity over the long term. This makes sustainable forest management and financial revenue from forest products more realistic goals. Forest management planning advice is also obtained more cost-efficiently for larger woodlands.

## CHANGING IDEAS ABOUT "EDGE"

Landowners who have listened to messages from conservation agencies over the years may find a focus on forest interior to be a break from the past. Even a decade ago, agencies and landowners often sought the greatest amount of diversity through greater, artificially-created edges. This was done with the best of intentions and with the best information available at the time. But just as improved knowledge and scientific study have changed (for the better) how we manage sustainably for timber and farm crops, so has greater understanding of ecology changed traditional views on habitat enhancement.

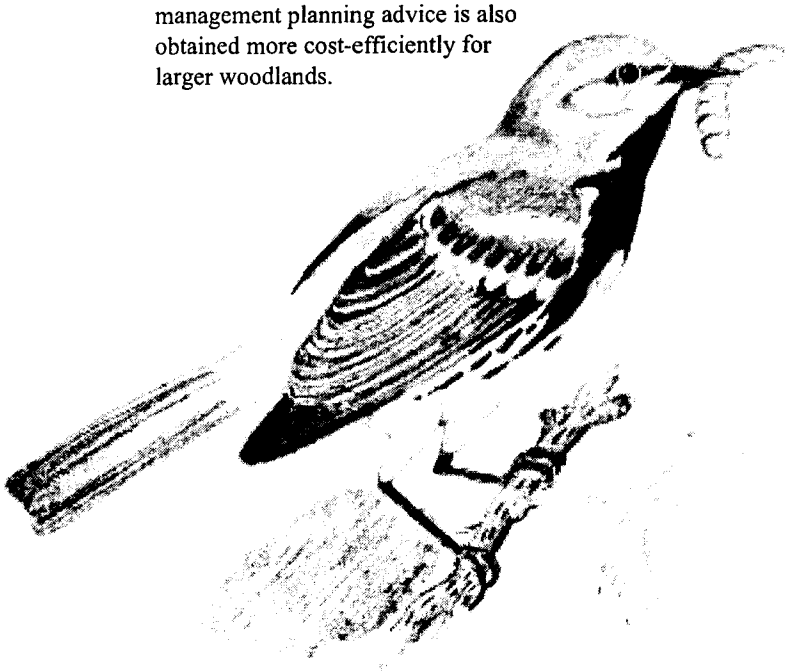
The shift came slowly after long term bird-banding studies, countless hours of field observation, satellite imagery, computer models, geographic information systems and the cooperation of hundreds of landowners made it possible to see declining trends in forest bird populations that are directly related to the loss of forests and forest interior.

## FOREST BIRDS HELP FOREST TREES

Warblers, vireos, and other insect-eating birds consume vast quantities of forest insects. There would be far more devastating outbreaks of gypsy moth, forest tent caterpillar and other pests without these birds in the forest. But even when foliage-eating insects are at lower (non-outbreak) numbers, they can have serious impacts on forest trees and tree growth.

Forest researchers in the southwestern U.S. covered white oak tree seedlings with netting and left others open to the sky to compare what happens to seedlings' insect populations with and without the feeding by birds. They found that plants had twice as many foliage-eating insects when nets kept the birds away. They also found that insects consumed 25 per cent of the total leaf area — equal to one in four leaves — when they were free of bird predation. This is twice the damage caused when birds were able to do their job of eating insects.

Natural biological control is not limited to insects. Porcupines, for example, can damage many species of hardwood and other trees by feeding on bark and twigs. Their main natural predator, the fisher, needs landscapes with larger tracts of forest. Without this habitat (and without the fishers) porcupine feeding often goes unchecked.



Black-throated Green Warbler

**2. PROTECT WOODLANDS WITH FOREST INTERIOR IN MUNICIPAL PLANS AND DEVELOPMENTS**

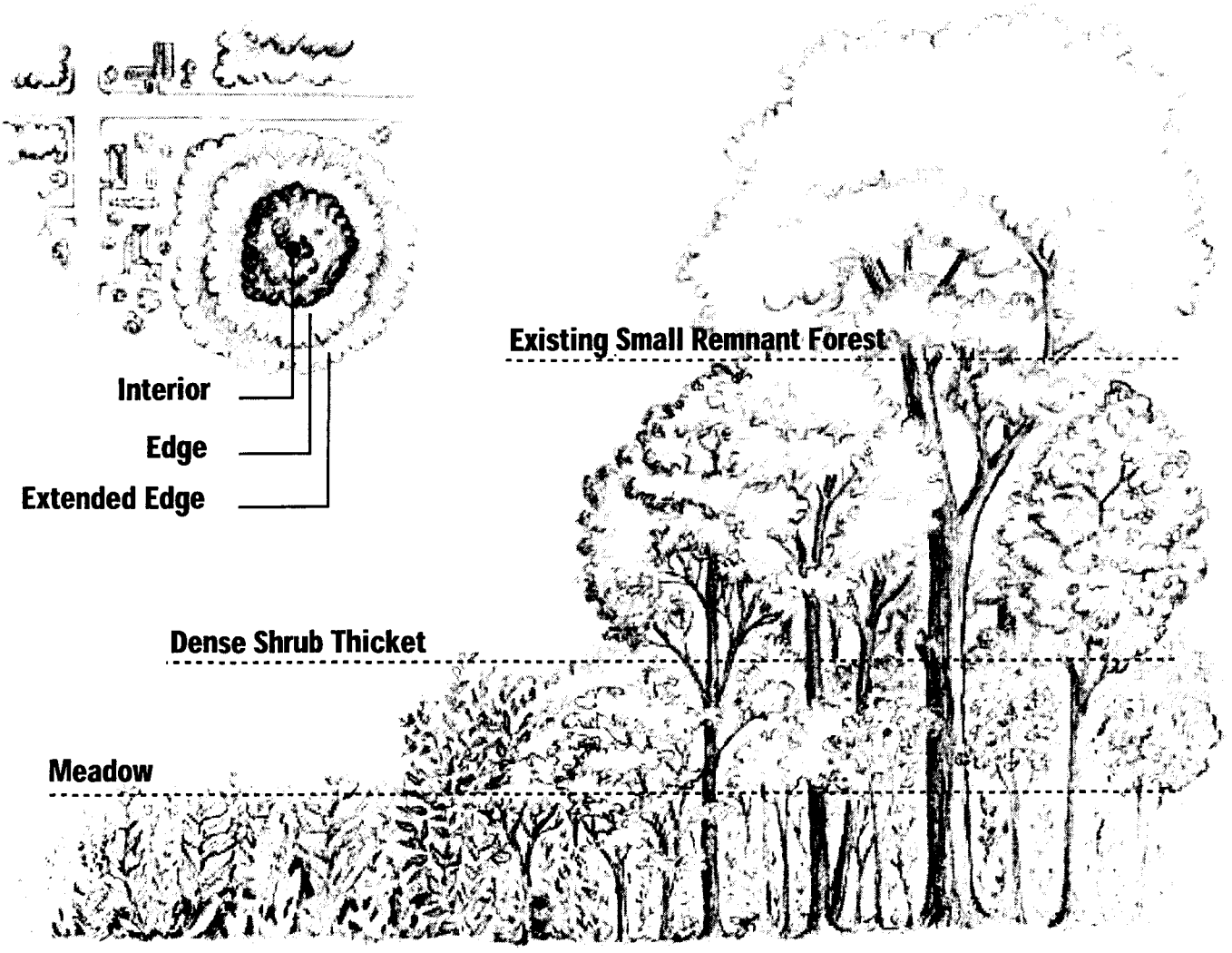
Large forests with extensive forest interior and habitat for threatened or endangered forest interior birds should receive special consideration in planning documents and in development proposals. Local input is often needed to raise the profile of these significant habitats in the municipal planning process. At the scale of the individual property, buildings should be kept at a distance from woodlands. Buffers should be maintained or created around small woodlands, especially where they are adjacent to high-density human habitation.

**3. IDENTIFY FOREST INTERIOR IN WOODLAND MANAGEMENT PLANS**

Landowners can identify forest interior protection for wildlife habitat as a property objective in forest and resource management plans. These plans help you look ahead and encourage you to think about how to improve your forest over time. The plans may also make you eligible for tax breaks or special management or assistance programs.

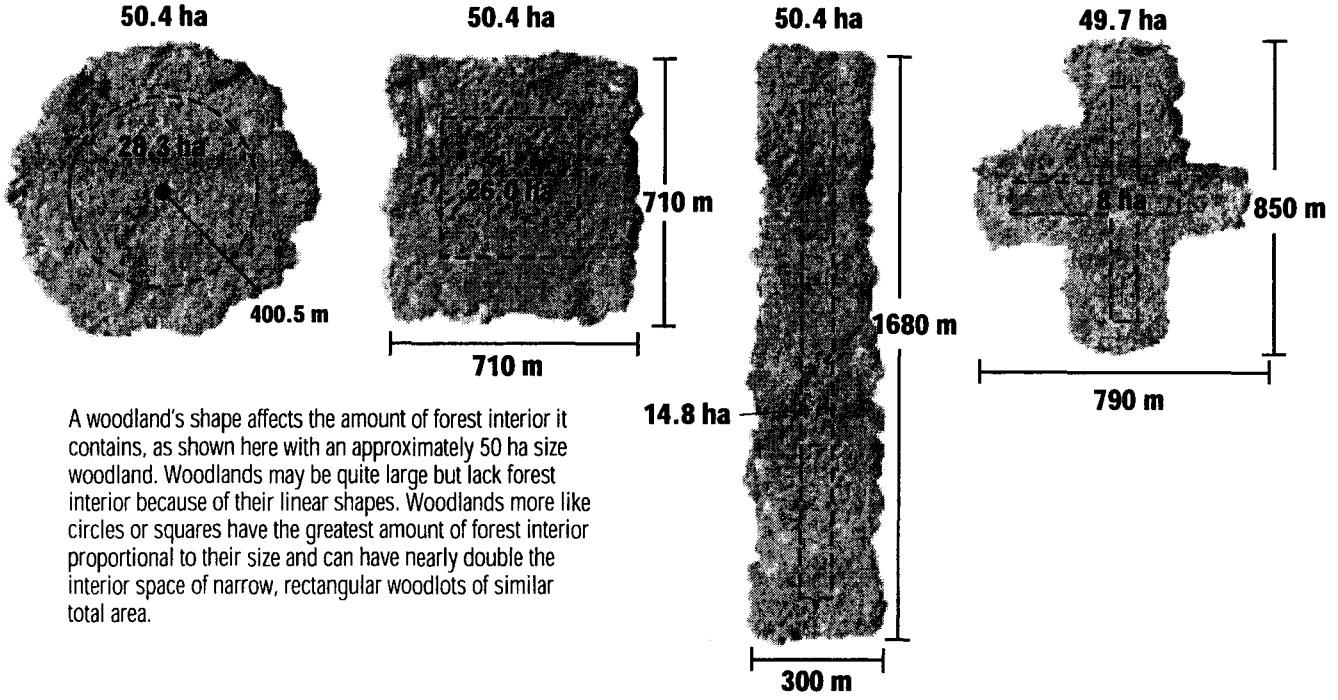
If you plan to cut your woodland, maintain an interior-protecting buffer by reducing the harvesting of trees along the edge, along riparian corridors or around forest pools (even

## BUFFER PLANTINGS




Planting and maintaining a 100 metre or wider border around small woodlands that support forest interior birds is a valuable landscaping technique that limits access and provides some natural buffering. Consider a planting that provides a gradual transition from meadow to shrub-thicket to the actual edge of the existing small forest. Alternatively, consider planting a border of dense conifer seedlings.

## FOREST GEOMETRY




A woodland's shape affects the amount of forest interior it contains, as shown here with an approximately 50 ha size woodland. Woodlands may be quite large but lack forest interior because of their linear shapes. Woodlands more like circles or squares have the greatest amount of forest interior proportional to their size and can have nearly double the interior space of narrow, rectangular woodlots of similar total area.

those that dry up in the summer). Forest interior conditions can be maintained through selection harvests when roads and landings are minimized and non-permanent, and when harvesting activities take place in the winter (non-breeding) season. Simply not scheduling any harvesting activities in the forest interior is also considered good management. Refer to the Extension Notes *Do You Have a Healthy Woodlot?* for help in planning woodland activities that help forest interior and habitat conditions.

### 4. PROTECT OLD-GROWTH FORESTS OR MANAGE WOODLANDS FOR OLD-GROWTH CONDITIONS

Forest interior conditions are common elements of old-growth forests or forests that contain sections of large, old, mature trees. You can adjust single-tree selection silviculture prescriptions (that aim to optimize timber production) to maintain old-growth forest interior habitat. This includes leaving a higher basal area and a greater number of larger diameter (greater than 50 cm DBH) trees than specified in typical prescriptions. Maintaining surface water sources such as springs, seeps and pools is also important. Refer to the Extension Notes *Restoring Old-Growth Forest Features to Managed Forests in Southern Ontario* and *The Old-Growth Forests of Southern Ontario* for ideas.

### 5. WORK WITH NEIGHBOURS TO COLLECTIVELY MANAGE AND PROTECT LARGE WOODLANDS

Properties boundaries are often the hidden cause of fragmentation. Conflicting management objectives among neighbours can reduce forest interior values in a number of properties. Long-term cooperation and multi-property planning are needed if landowners hope to increase the size of, and connections between, fragmented forests or if they wish to conserve habitat conditions in large woodlands. Look at your land as just one part of the larger landscape. What position does your property occupy? Does it have forest interior habitat, old-growth, wetlands or connecting corridors to habitat on neighboring properties? Ask yourself what you and your neighbours can do together to benefit woodland habitat. This could involve simply leaving things be — southern Ontario has many fine examples of private stewardship. Conservation agencies and groups encourage this cooperative approach and welcome the participation of interested landowners.

### 6. ENCOURAGE NATURAL SUCCESSION OR PLANT NATIVE TREES IN FOREST CLEARINGS

You can greatly increase the amount of forest interior by reforesting permanent fields within woodlands. The benefits are most dramatic in large woodlands. For example, planting trees in a one hectare field within a small woodland may only create one hectare of forest interior. The same-sized field in a large woodland may create 50 hectares of forest interior, depending on the shape of the woodland.

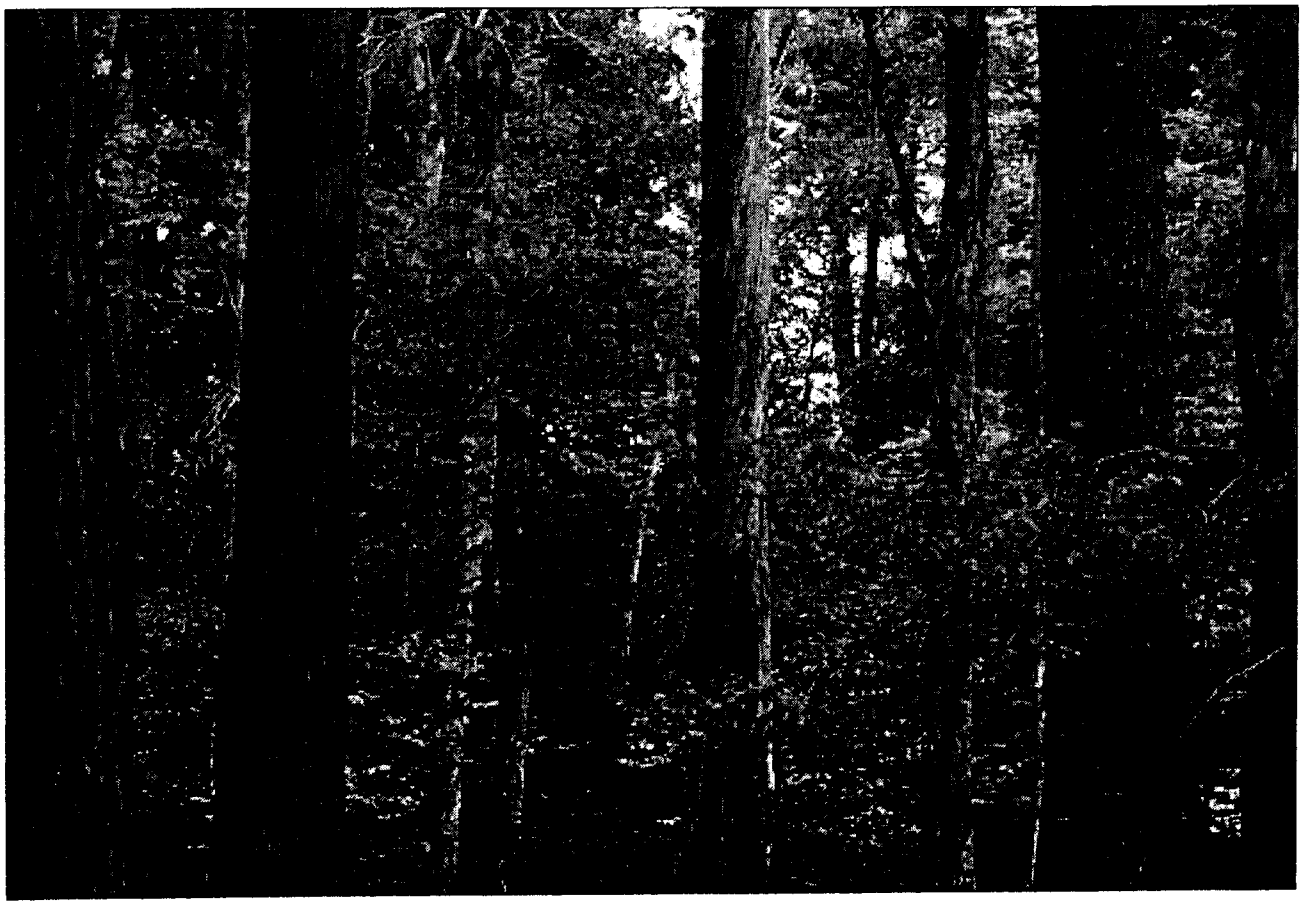
You may not want to plant trees in small openings (less than one hectare) because natural succession will likely restore the forest for you. You can encourage natural regeneration and germination of seeds around the forest edge by gradually exposing mineral soil with passes of a cultivator over several years. Refer to the Extension Note *Management Options for Abandoned Farm Fields* for more information.

### 7. INCREASE THE SIZE OF WOODLANDS BY PLANTING NATIVE TREES AROUND THE EDGE

Use annual planting projects to reduce edge and "round out" your woodland. You can use fast-growing conifer plantations as stepping stones to increased forest interior. If plantations exist adjacent to natural forest, they can be managed to increase species diversity and vertical structure. Refer to the Extension Note *Managing Regeneration in Conifer Plantations to Restore a Mixed Hardwood Forest* for management approaches or a number of other Extension Notes that provide information on preparing for, planting, and protecting trees. Consider planting a few rows of conifer trees around the edges, especially the southern and most exposed edges of smaller woodlots with remnant forest interior habitat.

## NATURAL FOREST GAPS IN THE FOREST INTERIOR

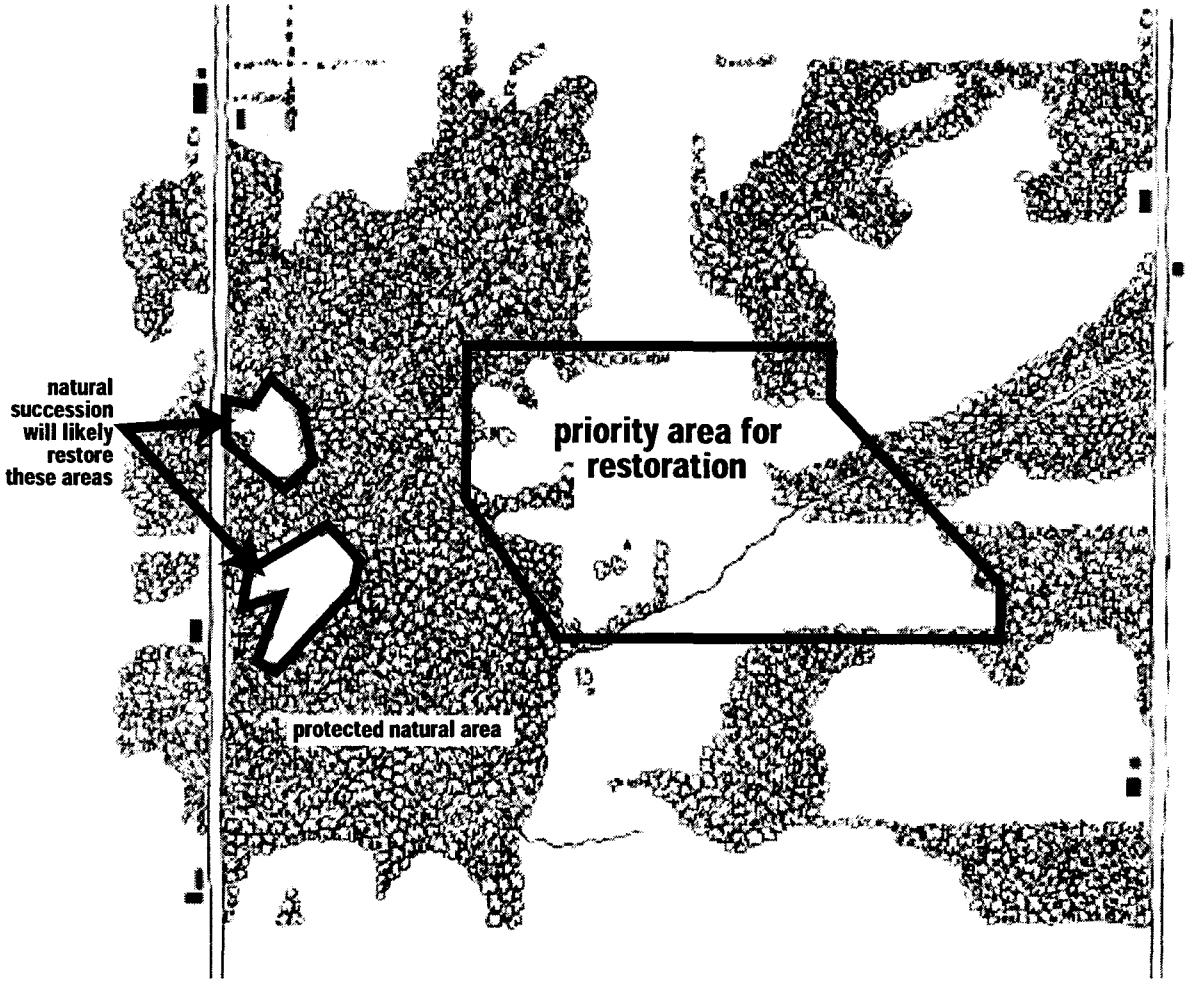
When old towering trees die they create openings and edge habitat in the forest interior. But the gaps are short-term. Many plant species are ready for this event and grow rapidly upwards into the available space. Some forest interior species, such as the hooded warbler, actually prefer small natural gaps in the midst of, and ringed by, a tall forest canopy.



Canopy gaps are created when small groups of trees die from old age or disease.

## RESTORING THE CORE

A large clearing within a woodlot drastically decreases the amount of interior habitat while increasing the amount of edge. These clearings differ from natural canopy gaps in many ways (see sidebar on previous page). Planting trees in these openings has tremendous conservation benefits.




### 8. CONNECT THE WOODLOTS

You can create wildlife travel corridors and expand forested areas by connecting existing woodlots, old fields, wetlands, lakes and waterways with natural vegetation. If two woodlots are close together, plant native trees between them to create one larger forest. Plant natural vegetation along the edges of lakes, rivers, streams, creeks, and riparian areas because these natural features make the best wildlife corridors. You can choose to enhance hedgerows and windbreaks as well because they need to be more than a single line of trees to be a suitable wildlife corridor.

### 9. ASK FOR HELP

Protection and restoration of large woodlands and woodlands with forest interior are two of the most important things landowners can do for wildlife in southern Ontario. But often these projects are large, complicated and costly. Ask conservation groups or government agencies for help to tie-in to existing programs. Contact the Ontario Ministry of Natural Resources or the Ontario Ministry of Agriculture, Food and Rural Affairs or your local Conservation Authority for information on existing stewardship and tree planting assistance programs.

## GLOSSARY

**BIODIVERSITY**
Also called biological diversity, this term refers to the variety of and variability among living organisms and ecosystems. Biodiversity includes all the different plants, animals and other species, but also how they are grouped together in natural communities and how they interact with the physical environment.

**CANOPY**
The forest canopy is the layer of foliage formed by the crowns of older trees. It shades the layers of vegetation below.

**(WILDLIFE) CORRIDOR**
Linear naturally-vegetated areas — ranging from hedgerows to river valleys — that link or border natural areas in the countryside. Corridors provide passage for animals and reproductive interchange between populations of plants and animals in fragmented landscapes.

**FOREST INTERIOR**
Blocks of forest more than 100 metres inside a woodland. This is roughly three to five tree-lengths away from a woodland edge, road, utility corridor or any large, usually permanent, opening inside a woodland. The 100 metre distance is a minimum because large openings cause changes to forest environments 300 metres or more inside woodlands.

**NEOTROPICAL MIGRANTS**
Birds that breed here but migrate to Central and South America in winter.

**NATURAL HERITAGE**
Natural means to exist or be caused by nature, and heritage is a valuable thing worthy of protection that we pass on to future generations. Natural heritage, therefore, refers to all wild plants and animals and, especially, the natural places they inhabit because habitat is the key to sustaining species — as a living heritage — over the long term.

**VERTICAL STRUCTURE**
Distinct layers of vegetation in forests. Beginning at the top and descending toward the forest floor, the layers include the dominant trees of the canopy which shade the understorey trees, saplings and shrubs. Cavity trees and supercanopy trees add further diversity to this structure.

## FURTHER READING

There are nearly a dozen Extension Notes to help you in the tree planting projects suggested here. For information contact the LandOwner Resource Centre at 1-800-387-5304. The following Extension Notes provide related information about forest interior habitats:

- *Do You Have a Healthy Woodlot?*
- *Restoring Old-Growth Features to Managed Forests in Southern Ontario*
- *The Old-Growth Forests of Southern Ontario*
- *Managing Regeneration in Conifer Plantations to Restore a Mixed Hardwood Forest*
- *Management Options for Abandoned Farm Fields*

For additional information consider the following publications:


- Bird Studies Canada/Long Point Bird Observatory. 1998. *Conserving Woodland Birds in Southern Ontario.* Bird Studies Canada. 16 pp. Fact sheet available by calling 1-888-448-2473 or www.bsc-eoc.org
- Lompart, C., J. Riley and J. Fieldhouse. 1997. *Woodlands for Nature: Managing your woodland for wildlife and nature appreciation.* Federation of Ontario Naturalists, Don Mills, Ont. 1-800-440-2366.
- Riley, J.L. and P. Mohr. 1994. *The Natural Heritage of Southern Ontario's Settled Landscapes.* Ontario Ministry of Natural Resources Natural Heritage Information Centre, P.O. Box 7000, 300 Water Street, Peterborough, Ontario K9J 8M5 1-800-667-1940.



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**EXHIBIT C: HMANA Industrial Wind Turbine Siting and Monitoring Policy**

**HMANA Industrial Wind Turbine Siting and Monitoring Policy**

The following policy update was adopted by the HMANA Board of Directors on July 8,2008.

The Hawk Migration Association of North America's official mission is to conserve raptor populations through the scientific study, enjoyment and appreciation of raptor migration. As a scientific, educational and conservation organization, HMANA collects data from hundreds of affiliated raptor monitoring sites throughout the United States, Canada and Mexico, and publishes a journal Hawk Migration Studies that includes data from participating hawk watches as well as articles on raptor conservation and other issues impacting raptors.

HMANA is concerned about the threat posed by industrial wind energy developments to migrating, nesting and wintering raptors. Wind conditions favorable for industrial wind energy projects may coincide with locations where concentrations of raptors occur. Industrial wind projects have been placed and are being proposed along known migratory flyways and near nesting and wintering concentrations of raptors. Some industrial wind energy developments have been clearly demonstrated to cause high mortality rates in a variety of raptor species, frequently as a result of inappropriate siting.

The National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA) and other federal legislation require federal agencies to carefully consider and assess the possible adverse effects in their projects and permitting practices. HMANA supports federal guidelines for the siting of wind power projects that are consistent with and at least as rigorous as provisions in the NEPA, the ESA, the MBTA and other existing federal legislation.

HMANA urges the establishment of final and mandatory design and siting standards-international, national and state-requiring that developers of industrial wind energy projects avoid known bird migration pathways and daily movement flyways, avoid features of the landscape known to attract raptors (such as ridgelines and coastlines), avoid areas formally designated as Important Bird Areas and avoid documented locations of any species protected under the federal Endangered Species Act. Such requirements are consistent with the U.S. Fish and Wildlife Service interim siting guidelines proposed in July 2003, which HMANA strongly supports. Unfortunately, delays in establishing permanent and binding regulations or guidelines have meant a lack of clear, unambiguous federal guidance to the state and local governments that must make decisions regarding the proper siting of proposed projects.

As articulated by the U.S. General Accountability Office report of 2005 and the National Academy of Science report of 2007, there is currently a lack of knowledge about the impacts of new-generation turbines on raptors. Accordingly, HMANA urges the establishment and consistent application of pre-construction and post-construction monitoring procedures for industrial wind power projects that are capable of improving the understanding of risk to wildlife posed by industrial wind power projects. Because knowledge of raptor migration and other behavior patterns is incomplete and raptor monitoring demonstrates high year-to-year variability in numbers of migrants at most sites, mandatory design and siting standards must require the collection of at least three years of pre-construction study data for projects where landscape

features, natural history patterns or other data suggest raptor concentration is possible. Pre-construction studies of raptor behavior should not be limited to migration issues but should be comprehensive and include not only the risk associated with direct turbine strikes and possible avoidance behavior, but also terrestrial habitat degradation and its effects on nesting and wintering raptors, as well as the effect of such degradation on migrating raptorsâ€™ roosting needs.

When multi-year preconstruction studies confirm migration, wintering or breeding season concentrations of raptors in a particular area, then plans for development in that area should be abandoned and development forbidden; if such study shows minimal concentration of raptors, or if specific designs can be demonstrated to pose minimal danger to wildlife present in the area, then projects can be considered. In such cases, when developers have invested in diligent efforts to locate wind power development appropriately, it is still possible that post-construction monitoring might show an entire project or individual turbines to be particularly fatal to raptors: when this happens, turbines must be decommissioned or their operation suspended during the periods when the problematic turbines are found to be most destructive. Developers must agree to such remedial action as a precondition of project approval by federal, state and local permitting agencies.

HMANA urges that international, national and state and provincial standards for pre- and post-construction monitoring be promulgated and enforced that will make possible the scientifically valid assessment of risk associated with industrial wind power development. In light of the absence of binding standards for pre- and post-construction monitoring, monitoring protocols must be specifically designed for each project by qualified and independent consultants in collaboration with federal or national regulatory and conservation agencies (e.g. the USFWS), state or provincial agencies, appropriate non-governmental conservation and scientific organizations and independent experts. The protocol for this monitoring and the monitoring results must be peer-reviewed and publicly accessible.

HMANA supports alternative energy technologies if they can be shown to pose minimal risk to wildlife when appropriately designed, sited and developed. New approaches to wind turbine technology and design in particular might be possible in the near future that pose less risk to wildlife and habitat. HMANA urges investment in research into such new technologies and their development.